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PREVALENCE OF METABOLIC SYNDROME IN PRE-MENOPAUSAL AND POST-MENOPAUSAL WOMEN

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Abstract

Objectives: Metabolic syndrome is an emerging public health problem in South-Asia especially India. The present study was undertaken to estimate the proportion of metabolic syndrome among pre- and post-menopausal females, and compare the prevalence between the two groups.

Methods: An observational cross-sectional study was undertaken among the 100 pre-menopausal women and 100 post-menopausal women attending the outpatient Department of Obstetrics & Gynaecology. Women were investigated for fasting blood sugar, and lipid profile which included, serum low density lipoprotein, serum very low-density lipoprotein, serum total cholesterol, serum triglyceride (after overnight or 10-12 hours of fasting). The primary outcome was proportion of metabolic syndrome among pre-menopausal and post-menopausal women, and secondary outcome was comparison of prevalence of metabolic syndrome between pre-menopausal and post-menopausal women

Results: Prevalence of metabolic syndrome has been estimated as 18% among pre-menopausal women and 47% among post-menopausal women. Significantly higher proportion of post-menopausal women had metabolic syndrome than the pre-menopausal women. All the components of NCEP ATP III criteria were significantly higher and associated with post-menopausal status ($p<0.05$).

Conclusion: Menopause might be a significant predictor for the metabolic syndrome. Prospective cohort studies assessing peri menopausal and post-menopausal women for metabolic syndrome prevalence needs to be undertaken to confirm our findings.

Keywords: metabolic syndrome, menopause, postmenopause, epidemiology, India

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1. Introduction

Non-communicable disease (NCD) continues to have an increasing impact across the world. An estimated 41 million people died from NCDs (mostly cardiovascular illnesses, diabetes, malignancies, and chronic respiratory diseases) annually, accounting for 74% of all fatalities worldwide.[1] Metabolic syndrome (METS) or Syndrome X or Deadly Quartet is a complex metabolic condition with a cluster of cardiovascular risk determinants such as obesity mainly of central type, insulin resistance, glucose intolerance, dyslipidaemia, procoagulant state and hypertension.[2] Krishnamoorthy et al in their meta-analysis, estimated the prevalence of metabolic syndrome among the adult population of India to be 30%.[3] Also, it was found that the risk increases with the age, urban living people had higher prevalence compared to rural and tribal population and women had higher prevalence than the men.

Menopause is a natural physiological phenomenon occurring in the women of 50 years and above and nearly 40% of the women's life span comes within this period.[3] With menopause, there occurs a lot of changes in the metabolism of women which predisposes them to an increased risk for cardiovascular diseases. The relationship between menopause and metabolic syndrome is researched widely in the global scenario. In a global level meta-analysis, it was reported the pooled estimate of metabolic syndrome was 37.71% among post-menopausal women. [4] There are numerous theories which hypothesize for the increased occurrence of metabolic syndrome during postmenopausal period. Some argue that the increased abdominal obesity might attribute for the syndrome, while others quoted the change in hormones especially of decreased oestrogen and increased androgenicity might be the cause.[5]

Metabolic syndrome, though a global problem, is an emerging public health problem in South-Asia especially India. In India, there are limited studies on the burden of metabolic syndrome among the women in postmenopausal group, and the effect of menopause itself on metabolic syndrome. Hence, the index study was undertaken to estimate the proportion of metabolic syndrome among pre- and post-menopausal females, and compare the prevalence between the two groups.

2. Materials & Methods

The current observational study was undertaken among the women attending the outpatient Department of Obstetrics & Gynaecology in PGIMS, Rohtak from September 2021-August 2022. The pre-menopausal group included 100 reproductive age group women ≥45 years with regular menstrual flow for last 5 years and the post-menopausal group included 100 women ≥45 years of age with cessation of menses for the past 12 months. Women with current pregnancy or pregnancy in last 6 weeks, on hormonal medication, women who had undergone hysterectomy, women with thyroid disorders and other chronic diseases were excluded from the study.

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Sample Size:

Based on a previous study that reported the proportion of metabolic syndrome in post-menopausal females as 42% and in pre-menopausal women as 16%, at a 95% confidence interval and 5% relative allowable error, the minimum required sample size was taken 60 in each group.[6] We included all eligible women during the study period, which came to be 100 in each group.

Data collection

A total of 200 consenting participants who fulfil the inclusion criteria were selected among the women attending the OPD by random sampling. The eligibility of the women in the study was determined based on the history, physical and laboratory examinations. All eligible participants in this study were further evaluated as per the preformed proforma with respect to history, clinical examinations and biochemical tests. Based on the proforma, age, address and phone number, a detailed menstrual history was obtained which included their Last menstrual period, based on which women were classified as post- menopausal and pre-menopausal. The latter was further probed about the duration, length and regularity of their menstrual cycle. Personal history regarding the details on the dietary, smoking, regular exercise habits was enumerated. This was followed by a general physical examination and anthropometric measurement on individual wearing light clothing without shoes. Using a calibrated balance beam scale, the weight was determined while the participants was standing, accurate to the closest 0.1 kg. Height was assessed in upright position to the nearest of 0.1cm using calibrated measuring tape and the body mass index (BMI) was calculated. A measurement of the subject's waist circumference was obtained after the conclusion of an expiration and rounded off to the closest 0.1 centimetre, beginning at the place where the lower rib cage border and the iliac crest were thinnest. Blood pressure was assessed two times in the right arm while the subject was seated, using a standard mercury manometer and cuff. The first measurement was taken at an interval of 5 minutes minimum after the patient was seated, and the reading was repeated after a time period of 15 minutes. The results were rounded to the nearest 2 mmHg. After that, an estimate was made for both the systolic and diastolic blood pressures, as average.

Women were investigated for FBS and lipid profile which included, serum LDL, serum VLDL, serum total cholesterol, serum triglyceride (after overnight or 10-12 hours of fasting). The primary outcomes was proportion of metabolic syndrome among pre-menopausal and post-menopausal women and secondary outcome was comparison of prevalence of metabolic syndrome between pre-menopausal and post-menopausal women

Ethical clearance was taken from the Ethics Committee, PGIMS, Rohtak to undertake the study. Participant’s written informed permission was collected before enrolling them into the study. Statistical analysis was conducted in SPSS 26.0 (Trial Version). Categorical variables were expressed in frequencies and proportions. The Kolmogorov-Smirnov test was used to assess the normality of continuous variables, and the results showed that the variables were skewed. Mann-Whitney test was applied to test the association between menopausal status and continuous variables. The Chi-square test was used to analyse the data and determine whether or not there was a significant association between the category variables.

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Appropriate graphs were made for the results. Statistical significance was assumed at a p value of less than 0.05.

3. Results

In the present study, prevalence of metabolic syndrome has been estimated as 18% among pre-menopausal women and 47% among post-menopausal women (Figure 1)

Majority of the pre-menopausal women were in the age group 45 to 50 years (97%) and belonged to rural areas (66%). In contrast, majority of the post-menopausal women were in the age group 51 to 55 years (36%), followed by 45-50 years (31%) and hailed from urban areas (62%). Both the groups had a median parity of 2. Other socio-demographic and anthropometric characteristics of the pre-menopausal and post-menopausal women are enumerated in Table 1. The lipid profile, blood glucose, haemoglobin, bleeding time and clotting time of the study participants are listed in table 2.

Significantly higher proportion of post-menopausal women had metabolic syndrome than the pre-menopausal women. Similarly, all the components of NCEP ATP III criteria were also significantly higher and associated with post-menopausal status ($p<0.05$). (Table 3)

BMI was significantly higher among the premenopausal women with metabolic syndrome (Mann Whitney U-417, p-0.004) and post-menopausal women (Mann Whitney U-192.5, $p<0.001$). However, parity and age were not significantly associated with metabolic syndrome within the pre-menopausal and post-menopausal participants.

Table 1: Socio-demography characteristics of the participants

	Pre-Menopause (N=100)	Post-menopause (N=100)
Age Mean (SD)	46.7 (1.5)	53.9 (5.8)
Residential status		
Urban	34	62
Rural	66	38
Socio economic status		
Upper	4	1
Upper middle	24	18
Lower middle	38	39
Upper lower	31	40
Lower	3	2
Education		
Illiterate	16	38
Primary	55	49
Secondary	29	13
Smoker	8	10

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BMI Mean (SD) (Kg/m^2)	23.5 (2.8)	24.6 (4)
Waist circumference Mean (SD)(cm)	83.7 (8)	89.4 (12.5)

Table 2: Lipid profile and other haematological parameters of the study participants

	Pre-Menopause (N=100)	Post-menopause (N=100)
Lipid Profile		
TGL	132.7 (23.3)	145.5 (20.5)
HDL	60.5 (16.1)	51.9 (14.8)
VLDL	83.1 (30.6)	115.8 (37.2)
LDL	112.3 (27.9)	127.6 (25.1)
Cholesterol	151.9 (34.4)	157.9 (38.3)
FBS	100.3 (23.2)	116.9 (27.7)
Hb	9.4 (1)	10.5 (1.5)
BT	2.6 (0.4)	2.3 (0.3)
CT	4.8 (0.4)	4.7 (0.4)

Table 3: Association of metabolic syndrome & lipid profile with menopausal status

	Pre-Menopause	Post-menopause	p value
Metabolic syndrome			
Yes	18	47	<0.001
No	82	53	
Waist Circumference			
Normal	79	52	<0.001
Abnormal	21	48	
FBS			
Normal	62	25	<0.001
Abnormal	38	75	
TGL			
Normal	76	24	0.003
Abnormal	24	44	
HDL			
Normal	90	71	0.001
Abnormal	10	29	

Figure 1: Prevalence of metabolic syndrome among study participants

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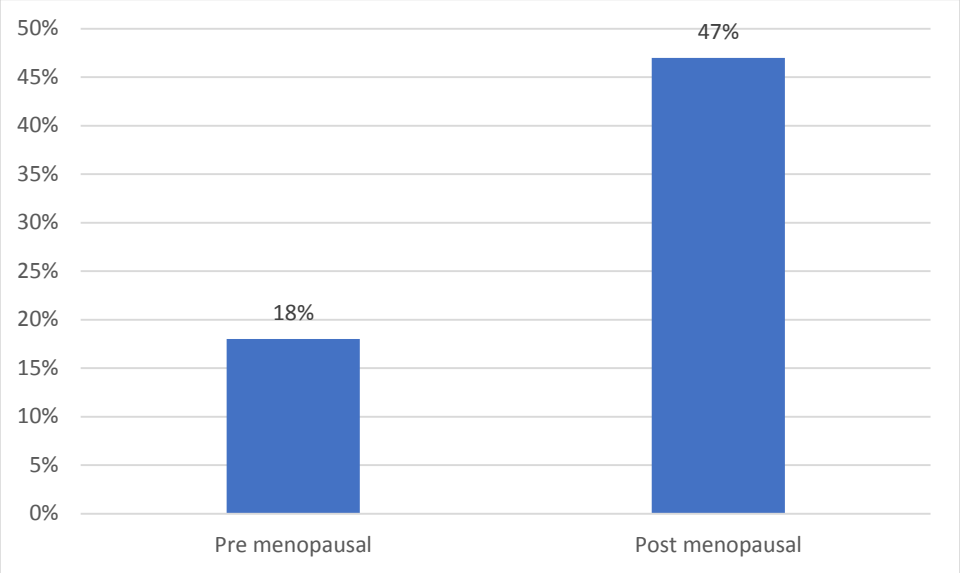

4. Discussion

Metabolic syndrome has been associated with multiple complications and morbidity. Menopause has been postulated as one of the factors that causes higher incidence of metabolic syndrome among females, owing to hormonal and bio-chemical changes that occurs with it. In the index study, the prevalence of metabolic syndrome was 47% among post-menopausal women & 18% among pre-menopausal women.

Also, we found a significant association between the post-menopausal status and the presence of metabolic syndrome, which is in line with findings of past studies.[7–13] Mehndiratta et al reported a significant variance in incidence of metabolic syndrome between pre and post-menopausal women.[6] In contrast Sharma et al reported no such association, which might be due to comparable age group between the two groups.[14] Heidari et al showed a progressive increase in the occurence of metabolic syndrome between the women in pre-menopausal, menopausal and post-menopausal stages, reiterating the independent effect of menopause in metabolic syndrome occurrence.[15] Janssen et al in their prospective cohort study established menopause is a significant predictor of metabolic syndrome.[16]
The processes underlying the link between MetS and menopausal transition are still not completely understood. It's possible that ovarian failure with oestrogen insufficiency is the direct cause of the development of metabolic risk factors in the post-menopausal era.[10] It's likely that fluctuations in oestrogen levels can significantly change how triglycerides are metabolised and how fat is distributed in the early stages of menopause. Other metabolic problems will then manifest as a result of the menopause-related worsening of oestrogen deprivation.[17] A large amount of post-menopausal women's elevated cardio-metabolic risk factors are assumed to be caused by a decrease in oestrogen production. A variety of age-related variables may combine to cause changes in metabolic risk factors during and after menopause.[10] Although earlier research indicated that age was the main factor contributing

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to an increase in the incidence of MS, it has been found that women over 50 had a greater prevalence of the disease than males of the same age.[12]

MetS prevalence rises throughout the menopausal transition as testosterone gradually takes over the hormonal environment, regardless of age and other significant variables. This has been postulated one of the potential reasons behind the high incidence of Metabolic syndrome during peri-and post-menopausal stages in women.[16] Menopausal transition period has a significant role in the occurrence of metabolic syndrome.[7,18,19] This needs to considered and studied in the future studies in the current settings. Prevalence of metabolic syndrome from various studies are enumerated in Table 4.

Table 4: Prevalence of metabolic syndrome in various studies

Study	Criteria	Pre-menopausal women (%)	Post-menopausal women (%)	p value
Heidari et al (2010)	NCEP ATP III	44.9	64.3	0.010
Cho et al (2010)	NCEP ATP III	6.6	35.9	<0.001
Maharlouei et al (2013)	1. NCEP ATP III 2. Insulin diabtes federation (IDF)	30 32.2	51.2 53.2	<0.001
Jesmin et al (2013)	NCEP ATP III	16.8	39.3	0.001
Jeenduang et al (2014)	NCEP ATP III	17	29.4	0.005
Sharma et al (2016)	NCEP ATP III	59.4	65.7	0.224
Marchi et al (2017)	NCEP ATP III	9.4	22.2	<0.001
Mehndiratta et al (2020)	NCEP ATP III	16	42	<0.05
Present study	NCEP ATP III	18	47	<0.001

In the present study significantly higher proportion of post-menopausal women had abnormal Waist circumference than the pre-menopausal women, which is similar to the results of previous studies.[6,8,11] Significantly higher proportion of post-menopausal women had abnormal Fasting blood sugar than the pre-menopausal women which is similar to the findings of other studies in literature. In the index study, higher proportion of post-menopausal women had abnormal triglycerides than the pre-menopausal women, in line with the studies in the past.[6,8,10,11,14]

Significantly higher proportion of post-menopausal women had abnormal HDL than the pre-menopausal women, similar to previous studies.[6,8–10] The greater decline in oestrogen

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than androgens, together with rising levels of LDL cholesterol and falling levels of HDL cholesterol, raise the likelihood of developing MetS throughout the postmenopausal period.[4]

Age was not a significant determinant of the metabolic syndrome among post-menopausal women, in our study, which is line with the findings of Jayashree et al.[3] Our study found a significantly higher BMI among the post-menopausal women with metabolic syndrome than the ones without metabolic syndrome, which is also reverberated by Jayashree et al and Marjani et al.[3,20] Cho et al reported a similar result wherein BMI to be significantly associated with overall presence of metabolic syndrome, while age had no such impact.[8] Thus, a key risk factor for metabolic syndrome is menopause. After menopause, the majority of the metabolic syndrome's individual elements are negatively altered.

However, the present study is not without limitations. Owing to the cross-sectional nature of the study, the temporality in association between the menopausal status and metabolic syndrome cannot be assessed. The number of years since menopause which is also a potential risk factor for menopause was not evaluated in the present study. Also, the study was conducted in a single centre, hence the generalisability of our findings to women from other states and institutes is limited.

5. Conclusion

Prevalence of metabolic syndrome has been estimated as 18% among pre-menopausal women and 47% among post-menopausal women in present settings. There is a significant association between the post-menopausal status and the presence of metabolic syndrome. Prospective cohort studies assessing peri menopausal and post-menopausal women for metabolic syndrome prevalence, studies on the late pre-menopausal women needs to be established to study the transition period and its impact on the metabolic syndrome in women in India. This will assist in identifying the cardiovascular risk associated with Metabolic syndrome, which in turn helps us to manage and prevent the subsequent morbidity and mortality.

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Conflict of Interest: None

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